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MARINE SCIENCES IN EGYPT, UAR

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UNITED STATES OF AMERICA

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Of the four marine science facilities in Egypt, three have been visited on two occasions by ONR London scientists. Dietz (ONRL-14-56) visited the Department of Oceanography, University of Alexandria, the adjacent Hydrobiological Institute and the Department of Marine Biology, University of Cairo, with its field station at Suez. Seven years later Haderlie and Richards (ONRL-31-63) visited these same institutions, giving detailed information on the staff, their research interests and facilities, and noting the changes which had occurred since Dietz's visit. Prior to the Middle East conflict of May 1967 I had occasion to visit these facilities again, as well as to make a short trip to the Marine Laboratory at Al-Ghardaqa on the Red Sea. This report will attempt to give a current listing of scientific personnel at these institutions, describe the research facilities and equipment, and generally comment on the progress in attaining the goals which were described in 1963 (Haderlie and Richards (ONRL-31-63)) as well as indicate the general trends in 1967.

Department of Oceanography, University of Alexandria

The Department of Oceanography, described by Haderlie and Richards as the center of Egyptian oceanography, is the only educational institution to maintain an active program of training and research in the marine sciences. Administratively it is set apart from the other institutions in that it comes under the Ministry of Higher Education; and the Dean of the Faculty of Science, Prof. Ramadan, previously a marine biologist whose interests included plankton and life histories of marine crustaceans, is obviously determined that the University program will receive as much support as possible. The staff of the Department has increased from six to ten during the last four years, largely due to the return of four* younger scientists, three of whom were completing doctorate degrees in foreign universities.

They are as follows:

Dr. Anwer Abdel Aleem, Professor	Marine algae
Dr. G.A. Botros (Kiel)	Fisheries biology
Dr. Saad K. El-Wakeel (Liverpool)	Marine geochemistry
Dr. Y. Halim (Paris)	Marine phytoplankton
Dr. A.M. El-Maghraby (London)	Zooplankton
Dr. Selim Antorn Morcos (Kiel)	Chemical and physical oceanography
Dr. Naim Dowidar* (Alexandria)	Zooplankton
Dr. Altaf Ezzat* (Marseille)	Fisheries biology
Dr. S.H. Sharef El-Din* (Liverpool)	Physical oceanography
Dr. Massoud A.H. Saad* (Kiel)	Limnology

In the half day which was available to me at the University of Alexandria it was not possible to talk with all of the staff individually. It was possible, however, to note the specific interests and research of some of them. Aleem, although almost completely occupied with administrative and teaching duties, continues to try to do some research on marine algae or write up results of some of his earlier studies. One manuscript which is completed but cannot be published because of lack of funds represents a 15-year survey of marine algae of the Suez with accompanying hydrographic data. He was most enthusiastic about the development of the Department in recent years. Although he does not have many opportunities to mix with Western European scientists, he did attend the 2nd Oceanographic Congress in Moscow and presented a paper on distribution and ecology of seagrass communities in the Indian Ocean based on observations made aboard the R/V ANTON BRUUN. Some of these observations have been continued in the Red Sea. Aleem worked at Scripps Institution in 1955, and reflected from time to time on his visit to the US, asking about scientists that he had met during his stay.

Dr. Y. Halim was on leave from the Department, spending one year at the Biologische Anstalt Helgoland. I had met him there previously during the First European Symposium on Marine Biology, and we had discussed research as well as the philosophy of research and its administration. He is continuing his work with phytoplankton which of necessity deals predominantly with taxonomy and distribution. He has recently completed a study of seasonal qualitative and quantitative variations in phytoplankton in Alexandria waters, and obviously hopes that this first effort there will stimulate similar studies in other Egyptian waters.

Dr. A.M. El-Maghraby has left his earlier studies of the genus Sardinella and, perhaps reflecting his graduate training days at Queen Mary College, University of London, has turned his attention to zooplankton. In a cooperative study with Halim he followed the monthly variations in qualitative and quantitative distribution of zooplankton in Alexandria waters. More recently he has described the essential morphological features of the six naupliar and five copepodite stages of the harpacticid copepod Euterpina acutifrons, one of the important zooplankton organisms in the marine environment of the Alexandria region. Seasonal variations, in the adult and developmental stages both qualitative and quantitative, were also followed. El-Maghraby has also published the results of a study on seasonal variations in length of seven species of planktonic copepods from the Eastern Mediterranean, and described the zooplankton of Lake Menzalah, a marine lake at the northern periphery of the Nile Delta which is one of the more important fishing grounds in the Egyptian region of the UAR. He has extended this study to a second lake, Lake Quarum, and was to have reported on the work at the CIESM Congress in Bucharest, October 1966. Unfortunately, neither he nor the abstract were present at the Congress.

Selim A. Morcos has continued his interest in water, salt balance, and currents in the Suez with particular reference to changes in flow

which may result from the completion of the Aswan High Dam and elimination of the annual Nile flood. In former years, primarily because of the Nile flood, tremendous volumes of fresh water were discharged into the Mediterranean during the period between August and October. Much of this was then carried by prevailing easterly currents across the 40 miles to Port Said. There, assisted by prevailing northerly winds, it heaped up, raising the level of the Mediterranean and causing a southward flow in the Canal. For more than half of its length the Canal thus became substantially diluted by fresh water, sometimes by as much as 30% of its normal salinity. Approximately two-thirds of the way along the Canal, the Great Bitter Lake occurs. The salty bottom-strata of the Lake are constantly being dissolved, increasing the salinity in the Canal. When water currents flow south, the salinity of the Canal waters south of the Lake is increased. When the currents flow north, the increase in salinity occurs at the Mediterranean end, making variations in salinity a good measure of the direction of current flow. Morcos has made salinity measurements since August 1966, the time when the Aswan High Dam was completed, which indicate that the usual seasonal dilution of the northern end of the Canal waters did not occur. He postulates that the seasonal alternation of this current will no longer take place. Morcos, who received his PhD from Kiel in approximately 1960, spent 1965-66 at the Institute für Meereskunde, Kiel on leave from the Department.

Of the four new staff members, three have just returned from studies in foreign universities, and have only begun to develop their research at Alexandria. Dowidar, completing his doctorate at the University of Alexandria, will continue his studies on zooplankton of Alexandria waters, presumably emphasizing the decapod larvae on which he worked for his degree. Massoud A.H. Saad, who worked for several years with Dr. W. Ohle, Max Planck Institut, Plon, Germany, is confronted with the responsibility of developing a school of limnology in Egypt. He has corresponded with me as recently as early August, 1967, and is especially anxious to correspond with limnologists in the US. Mrs. A. Ezzat will presumably join with Dr. G.S. Betros and continue studies on the biology of fishes, but their specific interests were not mentioned. A. Ezzat was apparently associated with the Alexandria Institute of Hydrobiology before doing graduate work in France, and was involved in studies on ecology of emphipods in the Nozha Hydrodrome, a portion of Lake Maryut which was converted for sea-planes during the war and is now used as an experimental fish-farm.

In the graduate program of the Department two students in addition to Dowidar were completing work for the PhD and two for the MSc. A. Samaan, utilizing C^{14}, has finished a study of productivity in Lake Maryut and S. Wahba was completing a thesis on hydrochemistry and sediments of Lake Mawzala and Lake Maryut. For the MSc F.K. Fahmy was following photoplankton development in fish ponds to which artificial fertilizer had been added, and Mrs. N. Bishara was studying growth and feeding in two species of mullet. Thirty students were involved in the portion of the program for "Diploma of Higher Studies," awarded for a one-year study

following the BSc. During the academic year 1966-67, 15 students were receiving grants from the Supreme Council for Scientific Research and an equal number were supported by grants from the Organization of Aquatic Resources. At the time of Haderlie and Richards' visit in 1963 the Department offered only a graduate program in oceanography. This program has now been revised and undergraduate students may take a number of oceanographic courses during their third and fourth years. The "Diploma of Higher Studies" program has been modified to permit students with a BSc who majored in zoology and chemistry to take one curriculum, while those students with only two years in the sciences may take a slightly different curriculum. The courses which are offered in these programs are included in the Appendix.

The physical plant for oceanography has changed little since 1963. At that time plans were discussed for the construction of a new oceanographic building adjacent to the Institute of Hydrobiology on the waterfront of the north spit of the Eastern Harbor. Although the property has been acquired, the lot filled and graded, breakwaters and a pier built, there was no evidence of construction or of plans for building. Aleem was still optimistic that the structure would be built, but more recent events may have delayed these plans considerably. In the interim Aleem has managed to obtain the use of two laboratories in the Hydrobiological Institute building at Kayet Bay. These were being renovated during my visit and presumably were to be used in connection with the joint grant which the Department and Institute had received from the Ford Foundation. This two-year grant, totalling $225,000, was to provide funds for some library facilities and books, some equipment and scientific instruments, training of three PhD students in foreign universities, and also to permit three of the staff to have one-year study tours in marine science facilities outside of Egypt. In addition a number of visiting scientists from the United States were to be funded.

There is little question about the need for adequate library facilities and scientific equipment. Very little modern equipment was in evidence, and it would be impossible to consider research other than systematics, descriptive ecology, and distribution with the facilities which were available. Even studies on distribution might be difficult. Although reference was made to the small launch EL-BAHITH, I got the impression that in recent years it has been used very little.

Oceanographic and Fisheries Research Centre, Alexandria (Institute of Hydrobiology)

Following the establishment of a Ministry of Scientific Research and the reorganization of science in the UAR (Richards, ESN-17-7-1963), this institute and the two previously administered by the University of Cairo, the Institute of Oceanography and Fisheries at Suez and the Oceanographic and Fisheries Research Centre, Al-Ghardaqa, came under the direction of the Supreme Council of Scientific Research. Prof. H.A.F. Gohar, previously

professor at Cairo University and Director of its two marine institutes, is a member of this Council and serves as General Director of the three institutes. Gohar, who previously spent a great deal of time at the Al-Ghardaqa station, is well known in the European scientific community and, judging from comments which have been made, is highly regarded. During the period 1940 to 1955, he was apparently involved in studies on several aspects of the coral reefs of the Red Sea, and published a number of papers in the Station bulletin on the Alcyonaria. In more recent years he has been too involved with administration to participate actively in the research, but continues to publish with some of the Al-Ghardaqa staff. At the time of my visit it was rumored that he would retire from the Council in the fall of 1967, and, as one might expect, there was considerable speculation as to who would replace him.

Mr. Samy Gorgy has recently assumed the role of Director of this group, and, unfortunately since he was occupied with a meeting during most of my visit, I could get little detailed information from him on the staff or their research programs. Information from other Egyptian sources, however, would suggest that there have been few changes in the staff since 1963. Gorgy, who previously has been involved in studies on the commercial fisheries in UAR Mediterranean waters, assumed the directorship early in 1966, replacing Mr. Ahmed Rifaat. He is now completely absorbed in administration and participated in the Bucharest meetings of the CIESMM in October 1966 as the official UAR delegate. Dr. S. El-Din El-Zarka, Dr. Mustafa Salah, and Mr. Rian Koura, apparently considered senior staff, were at the laboratory but not available for discussions. Fifteen other, younger scientists complete the staff of this Institute. From the complete set of publications which I was given it would appear that the "Notes and Memoires" series has not been published since No. 71, 1964. However, since the 1963 issue bears the number 73, there may be later numbers which I did not receive.

The Institute also maintains seven small survey centers which are associated with fisheries in a number of the freshwater lakes in Egypt. Although the lines of administration are not clear, one program was mentioned which may come under the freshwater section of this group. The UAR government has applied to UNESCO, the United Nations Development Programme, Special Fund, for evaluation and support for a five-year study to assist in the research and development of Lake Nasser. Lake Nasser, the new reservoir forming behind the Aswan High Dam, is expected to reach a retention level by approximately 1970 if the Nile's average flow conditions prevail. It will then have a maximum surface area of 5,000 square kilometers and a total capacity of 157 billion cubic meters. The plan would establish and operate the Lake Nasser Development Center which would be located on the outskirts of Aswan. The programs which would be attempted over a five-year period are:

a. Limnological study of the Lake's physical, biological and chemical characteristics, including research on aquatic vectors.

b. Studies on the life history, abundance, and distribution of major commercial species of fish as well as methods of exploitation, in order to evaluate the Lake's fishery potential and to prepare a fishery development program.

c. A study of alternative land uses along the reservoir shore, based on appraisal of relevant soil, agronomic and fishery findings.

d. Examination of public health problems arising from environmental changes.

e. Hydrological investigations of limited areas to help evaluate groundwater resources in the Nubian sandstone formations to the west of the Lake and the Kom Ombo area.

f. A limited research program to determine the effects of Lake Nasser on the micro-climate, to be carried out under subcontract with the UAR Meteorological Department.

The Center is to be organized into three units: a division which is involved in research; a division which arranges research contracts, both foreign and domestic, and provides facilities to universities and other groups engaged in research and training; and a third division to coordinate the results of the research and to advise on practical development problems. The outline of the program notes that the participation of universities and other research groups, both national and foreign, will be encouraged. Approximately $1.5 million has been requested for the program, to be matched by a sum equal to 15% of the estimated cost and "in kind" contributions by the UAR Government equivalent to $1 million.

Two other projects closely related to the development of the Aswan region have been approved by the UN Development Program; one involves an assessment of the mineral potential and the other is a soil survey of uncultivated lands suitable for irrigation that would use water from Lake Nasser. The state of these programs at the present time is not known.

The situation described for the Hydrobiological Institute by Haderlie and Richards in 1963 has apparently changed very little. Apart from a good library, the building at Qait Bay appears to be largely office space and is poorly suited to scientific research. There is no modern research equipment. An observation from one of their colleagues seemed sufficiently appropriate, to say nothing of amusing considering the setting and the atmosphere, to repeat: i.e., "The main problem there is that they have too many chiefs and too few Indians."

Institute of Oceanography and Fisheries, Ataqa (Suez)

On his return from NYU, Dr. E.S.M. Hassan assumed the directorship of this station which, as one of the stations previously associated with the University of Cairo, had been inactive for some time. Hassan,

a physical oceanographer, with two other staff members, Dr. A. Bayoumy and Mr. Choubri Nassif, is attempting to develop several programs at the Institute and also direct the research of approximately ten young BSc's. The relatively spacious frame building which is used for scientific purposes appears to date from the Second World War period, and the one wing contains the extremely limited library. Hassan has set up sections of chemical, physical and biological oceanography plus one in geophysics and spectroscopy. In every case the laboratory rooms are good sized, but the facilities for research are nil. The one or two exceptions were rather depressing. In one section there was a Ziess flame-photometer which has not been assembled for use and a spectrophotometer completely encased in a shroud of thin plastic to prevent damage by the dust and sand, which has never worked properly but cannot be repaired locally. Although I was told that the power was adequate and sufficiently stable for such equipment, a second opinion, not from an Egyptian scientist, indicated from first-hand experience that the power is rarely adequate and that sizable fluctuations are common.

The Institute is well situated as a base from which to study physical and chemical oceanography. It would be, however, virtually impossible to do any experimental biological work in this location. The Institute is located close to the entrance to the Canal and within perhaps half a mile of a sizable oil refinery. The shore is completely covered with oil, sludge, and the usual pollution which results from tankers and shore-based industries if precautionary measures are not strictly observed. Water for the sea-water tanks of the Institute, which also serves as a public aquarium, is pumped directly from the harbor through plastic lines to cement tanks. Surprisingly enough sea urchins and Thais were living in the tanks, but little else. Many of the iron-frame glass aquaria were empty and, judging from the accumulation of rust on the frames, they had not been used for some time. Next to the aquarium, a museum is maintained which contains painted fish and panoramic displays of Red Sea coral reefs and fish of the area. Many of them were not identified, and the one young fish biologist was unable to assist me with those that I inquired about or to provide the scientific name of the fish with which he was working.

Hassan, obviously a very capable but frustrated scientist, has developed plans for enlarging the Institute at its present location. The artist's sketch of the complex of proposed buildings, which incidentally would do justice to any of the leading oceanographic institutions in the US, has been considered by the Council for Scientific Research, but any construction has been deferred because of insufficient funds.

In the Institute library there were a few basic references, but other than a small number of Woods Hole volumes, I saw nothing in the way of a reprint collection or scientific periodicals. Hassan pointed out that since the Institute had nothing to exchange with other oceanographic laboratories and since the foreign currency exchange problems prevent the purchase of periodicals, they have little opportunity to acquire even the nucleus of an adequate library.

In addition to the scientific staff, the Institute employs a number of people in other capacities, and they, numbering approximately 100 with families, live in houses provided at the Institute.

Two small launches were visible behind the Institute, but according to one source of information, the motors have not been operating for some time, and many of the collections which are studied must of necessity be made from the shore.

Oceanographic and Fisheries Research Centre, Al-Ghardaqa

Dr. A.A. Al-Kholy has replaced Prof. H.A.F. Gohar as Director of this Institute, and in his absence, I was shown the facilities by one of the younger members of the staff, Dr. A.M. Eisawy.

For a number of years Al-Kholy has been interested in zooplankton of the Red Sea. In the late '50's and early '60's he published a number of papers on larval stages of brachyuran crustaceans, one describing some of the larval stages of three species of anomurans, and a similar study on macruran larvae. He has also had some interest in copepods, and one of his most recent publications describes several semi-parasitic copepods from the Red Sea.

Dr. Abdul F. Latif, another member of the staff who was not available, received his PhD from Moscow. I was told that he was interested in the physiology of fishes and that his most recent publications deal with studies on some digestive proteolytic enzymes of certain groups of fishes from the Red Sea.

Eisawy, who recently received his graduate degree from Tokyo University and worked on molluscan biology, returned to Al-Ghardaqa with an interest in developing methods for the culture of the pearl osyter on a commercial scale. This scheme has apparently been abandoned, and during my visit he was preparing several manuscripts on egg development and larvae of a number of molluscs from the plankton of the area. His most recent publications deal with mollusc and coelentrate development.

One of the younger members of the staff, M.I. Bebars, was to have attended the UNESCO course in Marine Biology which is given each year at the Marine Laboratory, Helsingør, Denmark. Bebars is interested in systematics of fishes of the Red Sea with particular reference to the family Scaridae.

Several of the people who were listed as staff of the Marine Station in the 1963 report of Haderlie and Richards have moved to other institutions. Dr. F.M. Mazhar is now associated with the Zoology Department, College for Girls, Ein-Shams University, Cairo. He has apparently retained his previous interest in elasmobranchs and, with Gohar, has published several papers on taxonomy, anatomy, and behavior of this group. Dr. G.N. Soliman,

previously listed as a part-time member of the staff, is now at the Zoology Department, Cairo University, and one of his more recent publications deals with coral-boring molluscs which are found at Al-Ghardaqa, suggesting that he continues to have an interest in the area and do some research at the Laboratory. He has also published on the biology and early development of a nudibranch, including observations on behavior and spawning.

The Institute was established as a Marine Biological Station in 1930 by Dr. C. Crossland, an Englishman who was Professor of Zoology at Fouad I University of Cairo (now, University of Cairo) and leader of the 1934-35 Expedition for Exploration of the Red Sea aboard the R.R.S. MABAHITH. According to Prof. G. Thorson, Marine Biological Laboratory, Helsingør, Denmark, Crossland was a very capable scientist. He married a Dane and was associated with the Zoological Museum of the University of Copenhagen during much of the period of World War II. Taking the morning train into Copenhagen, he frequently met Prof. Anton Brunn and together, with numbers of German occupation forces, they proceeded to the city and on to the Museum. Crossland was apparently quite hard of hearing and, during their morning commuting, is reported to have frequently asked Brunn in a loud voice "And what are the ------- Germans up to today?" From the other tales which Thorson tells of Crossland, it is easy to understand why, at his funeral in occupied Copenhagen in 1953, his Danish colleagues assembled and stood to pay their last respects by singing "God Save the King."

Crossland's choice of a site for a marine laboratory was an excellent one. It is located on the African side of the Red Sea, south of the entrance to the Gulf of Suez. Although road connections with Cairo exist, the trip requires a full day. MISR now maintains three flights to Al-Ghardaqa each week and the trip takes a little over one hour. The fauna in the area of the Laboratory appeared to be quite varied and rich, and there are extensive coral reefs within a five-minute row of the Station.

The research facilities of the Laboratory constitute the minimum requirements for any type of research. A few of the rooms had running sea water, but there was no evidence of equipment for experimental studies and even the optical equipment was poorly housed and maintained. Space for visiting scientists was available, but with the exception of two German graduate students who were collecting at the time of my visit, I have the impression that foreign scientists are quite rare. The library appeared to be the best part of the facility, presumably because the previous Director, H.A.F. Gohar, did maintain contact with a number of foreign scientists. Also, the annual bulletin of the Institute, Publications of the Marine Biological Station Al-Ghardaqa (Red Sea), does provide a mechanism of exchange, and Al-Kholy is apparently attempting to maintain this approach. The most recent volume, No. 13, was published in 1964, but I was told that the 1965 issue was then in press. Rather primitive facilities were available to house visiting

investigators, but two hotels have been built in the area within the last two years. One is about 10 miles away while the second is approximately five miles from the Institute. I was not aware of any vessels which could be used for collecting any distance from the shore.

General Remarks

The majority of the "senior staff" associated with the marine sciences in Egypt have received doctorates from foreign universities, where presumably they were well prepared for research and training in "modern" sciences. On their return to Egypt they have found themselves in a situation which would frustrate the most stalwart soul! Many of them, extremely capable men, are now totally involved in administration and "bio-politics." I was told that Al-Kholy, Hassan, Aleem, and Gorgy make weekly trips to Cairo to attend committee meetings, discuss plans for buildings and research programs, and generally indulge in "mending fences" and similar activities in the hope that professionally they will advance to positions of greater security.

The political climate in Egypt has done little to alleviate the situation, and the scientists are aware of the price that is being paid for some of the government's policies. For example, reference was made to the new Sorting Center that has recently been established by the Smithsonian in Tunisia, indicating that within the past two years there had been plans to have the Center in Egypt. When I asked why the plans had been changed, the Egyptian scientist replied quite candidly that the provision to develop an international facility, open to scientists from all countries, could not have been fulfilled if it had been placed in Egypt. The Egyptian Government's attitude to Israelis had forced the US to move it to Tunisia. Many of the scientists there would like to be involved in MAMBO and have their students participate in the courses which are offered. Although one was originally named to serve on the executive committee, he was not able to participate, and it is doubtful that students from the Egyptian universities will be permitted to attend those courses which involve Israeli scientists and students.

Although the scientists privately are sincerely interested in international cooperation, it is apparently impossible to convince the government that it is desirable. For example, the study of the Suez Canal and the migration of animals from the Red Sea and the Mediterranean are subjects which are of considerable interest to scientists throughout the world. Although a number of competent individuals have inquired about cooperative efforts to investigate these problems, it has been made quite clear that they will be studied by Egyptian scientists, with Egyptian equipment, funded by Egyptian money.

With virtually all of their time spent in administration, politics, and biopolitics, little is left for the direction of the younger staff or the students. The unfortunate attitude that science in Egypt must jump the gap from "A" to "P" immediately, without any provision for the fundamental concepts which fall between these two points, further complicates the picture. For example, at one institution large numbers of salinity

samples are being stored until time and facilities become available for analysis. Although they plan to perform some of the analyses with a modern flamephotometer, the samples have not been properly stoppered, and the resultant evaporation is quite obvious in some. At Al-Ghardaqa, with coral reef easily accessible, no one is interested in studies which make use of this unique community, but rather they expend what little support is available for research on pearl oyster culture or attempt a program on enzymology which requires equipment that is not available and, even if available, could not be maintained properly.

Modern research equipment is virtually non-existent in Egyptian institutions, and one of the major problems appears to be that even less sophisticated equipment cannot be kept in running order. One individual who had been visiting several of the marine facilities over a period of three months commented that nothing worked. The research vessel referred to in the report of Haderlie and Richards, FARAS EL BAHR, is an example of the general situation. The vessel was German built and operated, and after the War, was part of the reparations settlement with Israel. She was confiscated during the 1956 Middle East conflict and used for a short period for research. Now the German-built engines need replacement parts which are not available in Egypt, and apparently the problems of foreign currency exchange do not permit the purchase of the parts in Germany. Thus, in the absence of any research vessel the Egyptians have been forced to rely on the good-will of scientists and research vessels from friendly countries. In 1965 such a cooperative venture was attempted with one of the fisheries research vessels of the USSR and five cruises were made off the Mediterranean coast of UAR funded in part by UNESCO. The Egyptians retained the phytoplankton and water samples, but the macrofauna and data were taken to Sebastopol. Since then attempts by Egyptian scientists to obtain these samples and information have met with little success.

In reading over the report of Haderlie and Richards (1963), I have always felt that it carried the impression of optimism and hoped that my visit might substantiate their feelings and reveal continued and additional developments in that direction. This, obviously, was not the case. Most of the scientists that I met were friendly, although cautious, and eager for closer cooperation with western scientists. While financial assistance from private foundations and official agencies may help, the interests and abilities of the scientists to contribute to the development of the UAR will never be realized until the Government adopts a positive, constructive attitude toward international cooperation which includes scientists from most of the western countries.

APPENDIX I

CURRICULA IN OCEANOGRAPHY - UNDERGRADUATE COURSES (3rd and 4th years)

I - Group I (Students undertaking Physics, Chemistry, Pure and Applied Mathematics in the first year)

Ia - Physical Oceanography (B.Sc.3)

1 - Introduction to Physical Oceanography (60 lectures):

Physical properties of sea water, salinity and temperature distribution, currents and wind effect, water masses and their distribution. Dynamics of ocean currents, circulation of the ocean currents, waves and tides.

2 - Estuarine circulation and near shore processes (30 lectures):

Types of estuaries from the physical point of view and pattern of circulation in each. Dynamics of estuaries.

Practical studies (4 hrs. per week): Processing and representation of oceanographic data, salinity and temperature measurements, dynamical computations.

Ib - General Oceanography (B.Sc.3)

3 - The Marine Environments (30 lectures):

Introduction to Oceanography, Classification of marine environments, effect of physical and chemical factors on populations.

Practical (2 hr/week for one semester): Methods of collection and estimation of biological samples; measurement of standing crop.

4 - Chemical Oceanography (30 lectures):

Chlorinity, salinity, chemical composition of sea water, nutrients, dissolved gases, pH and alkalinity.

Practical (3 hr/week): Determination of chlorinity, salinity, alkalinity, pH and nutrients.

Ic - Submarine Geology (B.Sc.3)

5 - General Submarine Geology (30 lectures):

Origin of ocean basins, origin of water masses. Exploration of ocean floor, sounding, location of position at sea, construction of charts, bottom sampling devices, General terminology of submarine topography, relief of sea floor, elevations and depressions. Regions of ocean floor, shore line, beach, continental terrace and abyssal plain. Submarine valleys, shelf channels, sub-canyons. Geological importance of the sea, destructive and constructive processes. Recent marine sediments, constituents, classification and types.

Id - Physical and Dynamical Oceanography (B.Sc.4)

6 - Physical Oceanography (60 lectures):

Sounding ocean bottom, measurements of temperature, salinity currents, waves and tides. Underwater acoustics, radiations, evaporation and heat budget of the ocean.

Practical (4 hr/week): Includes experiments on the determination of sound velocity in different salinities and temperatures, radiations and hydro-optics, viscosity, conductivity and inductance.

7 - Dynamical Oceanography (30 lectures):

Basic dynamical theory, thermodynamics of the ocean.

8 - Regional Oceanography (30 lectures):

Identification of water masses, main water masses, their formation and circulation. Bottom configuration of oceans and adjacent seas with special reference to the Mediterranean and Red Seas. Hydrography of the Mediterranean and Red Seas with reference to Egyptian waters.

Practical Physical Oceanography (2 hr/week): Representation and processing of oceanographic data, with special reference to local data.

Ie - Marine Meteorology (B.Sc.4)

9 - Marine Meteorology (30 lectures):

If - Marine Survey (B.Sc. 4)

10 - Marine survey and cartography (30 lectures)

Practical (2 hr/week).

II - Group II (Students undertaking Zoology, Botany, Chemistry, Physics + Mathematics in the first year)

IIa - Biological Oceanography (B.Sc.3)

1 - Marine Biology (60 lectures):

Introduction to Oceanography, Biology and life histories of the different groups of plant and animal life in the ocean including: Marine Fungi, Algae, Sea grasses, phytoplankton, Protozoa, Coelenterata, Polychaeta, Crustacea, Mollusca, Echinodermata and Protochordata.

2 - Principles of marine ecology (15 lectures):

Basic interrelations of plants and animals with the physical and biological factors of the environment. Fundamental concepts of environmental biology: Ecosystem, biocoenoses, community and development of populations.

Practical studies (4 hr/week): Structure, morphology and anatomy of marine plants and animals in the local environment.

IIb - Biostatistics (B.Sc. 3)

5 - Biostatistics (15 lectures):

Application of statistical methods to biological populations.

IIc - Ichthyology (B.Sc.3)

4 - Ichthyology (30 lectures):

Morphology, anatomy, taxonomy, reproduction, life history and general fish biology.

Practical (2 hr/week): Dissection, identification and classification of fishes with special reference to Mediterranean and Red Sea fishes.

IId - Physical and Chemical Oceanography (B.Sc.3)

5 - Physical Oceanography (25 lectures):

Physical properties of sea water, thermal, sonic properties. Salinity and temperature distribution, water masses, tides, waves and currents.

6 - Chemical Oceanography (20 lectures):

Chlorinity, salinity, chemical composition of sea water, nutrients, gases in sea water, pH and alkalinity.

Practical Physical and Chemical Oceanography (2 hr/week): Representation of oceanographic data (20 hr/year). Determination of chlorinity, salinity, alkalinity, dissolved oxygen and nutrients (40 hr/year).

7 - General submarine geology (15 lectures):

History and origin of ocean basins, origin of water masses - Generalities of ocean basins: area, volume, depth, nomenclature and classification - General terminology of submarine topography, relief of sea floor, elevations and depressions - Regions of ocean floor, shore line, beach, continental terrace and abyssal plain - Marine environments of deposition, littoral, neritic etc. - Recent marine sediments, constituents, classification and types - Coral reef formation.

IIe - Biological Oceanography (B.Sc.4)

8 - Phytoplankton production and productivity (20 lectures):

Standing crop, production and productivity - Factors affecting phytoplankton production - Quantitative methods of assessing the standing crop - Methods of estimating primary production including the C-14 technique.

9 - Zooplankton ecology and behaviour (15 lectures).

10 - Populations in relation to environment (15 lectures):

Distribution and ecology of the plankton, nekton and benthos.

11 - Marine physiology and microbiology (25 lectures):

Osmotic regulation, feeding, metabolism, respiration, bio-luminescence - Distribution types and role of micro-organisms in the marine environment.

12 - Zoogeography of marine animals (15 lectures):

Survey of biogeographical regions and distribution of representative groups of organisms in the marine environment.

Practical biological oceanography (3 hr/week):

(1) Cultures of phytoplankton and quantitative estimations of standing crop (30 hr/year).
(2) Marine physiology (other than fish physiology) (30 hr/year).
(3) Breeding and metamorphosis of marine animals including Mollusc culture (30 hr/year).

IIf - Fishery Biology (B.Sc.4)

13 - Fishery biology and management (20 lectures):

Reproduction, fecundity, migration, food and feeding, age and growth - Population dynamics, optimum yield and optimum catch - Recruitment and mortality - World Fisheries with special reference to Egyptian fisheries, regulations and bylaws, prospects.

14 - Fish Culture (10 lectures):

Principles of fish culture - Fish farm design - Selection of mothers - Fish diseases.

15 - Fishing technique (10 lectures):

Net material and preservation, net classification and designing, net selectivity.

16 - Fish physiology and behaviour (10 lectures):

Digestive, circulatory, reproductive and endocrine, systems - Osmoregulatory mechanisms, respiration and metabolism serology - Fish behaviour.

17 - Fishery hydrography (10 lectures):

Effect of hydrographic, meteorological factors on fish behaviour and fisheries.

Practical fisheries (4 hr/week):

(1) Fishery biology and management (60 hr/year).
(2) Fish egg and larvae (20 hr/year).
(3) Fish physiology and serology (40 hr/year).

IIg - Limnology (B.Sc.4)

18 - Principles of limnology (30 lectures):

Study of the physics, chemistry, biology and geology of lakes, ponds and streams with particular reference to local environments.

Practical (2 hr/week): Includes limnological methods - Systematic study of representatives of brackish and fresh water fauna and flora of Egypt.

III - Group III (Students undertaking Geology, Biology, Chemistry and Physics + Mathematics in the first year).

IIIa - Biological Oceanography (B.Sc.3)

1 - Ecology of marine environments (30 lectures):

Introduction to oceanography, classification of marine environments - Study of planktonic and benthic communities with particular reference to biological productivity.

2 - Organisms contributing to shore formations and bottom deposits (30 lectures):

Systematic study of such organisms as Diatoms, calcareous Algae, Coccolithophores, Ebridae, Foraminifera, Radiolaria, Mollusca, Coelenterata and Echinodermata.

Practical (2 hr/week): Laboratory studies of marine groups of plants and animals contributing to shore formations and sediments with particular reference to coral reefs.

IIIb - Physical and Chemical Oceanography (B.Sc.3)

3 - Physical Oceanography (30 lectures):

Physical properties of sea water and dynamics.

4 - Chemical Oceanography (30 lectures):

Chemical properties of sea water, major and minor elements, nutrients, dissolved gases, chlorinity, salinity, CO_2 - System, pH and alkalinity.

Practical (4 hr/week): Chlorosity, chlorinity, salinity, dissolved oxygen, pH, alkalinity. Presentation and processing of data.

IIIc - Submarine Geology (B.Sc.3)

5 - General Submarine Geology (30 lectures):

History and origin of ocean basins, origin of water masses - Exploration of ocean floor, sounding, location of position at sea, chart construction, bottom sampling devices - Generalities of ocean basins, area, volume, depth nomenclature and classification - General terminology of submarine topography, relief of sea floor, elevations and depressions - Regions of ocean floor, shore line and shore processes, beach, continental terraces and abyssal plains - Submarine valleys, shelf channels and submarine canyons - Geological importance of the sea, destructive and constructive processes - Bottom configuration of oceans and adjacent seas with special reference to the Mediterranean and Red Seas.

6 - Petrography and principles of sedimentation (30 lectures):

Petrography of igneous, sedimentary and metamorphic rocks with special reference to sedimentary petrography, clay minerology, techniques in mineral analysis of sediments, mechanical analysis and graphic representation of data - Principles of sedimentation, environments of deposition with special reference to marine environments.

Practical (2 hr/week): Sedimentary petrography, mechanical analysis, microscopic study of grains and counting.

IIId - Biological Oceanography (B.Sc.4)

7 - Biological Cycles (15 lectures):

Study of the effect of environmental factors on production and turnover of populations, transfer of energy and elements in the food web.

8 - Paleoecology (15 lectures):

Consideration of the problems of lacustrine and marine paleoecology.

Practical (2 hr/week): Estimation of standing crop of plant and animal life - Study of Paleoecological representatives of plant and animal types.

IIIe - Physical and Chemical Oceanography (B.Sc.4)

9 - Physical Oceanography (30 lectures):

Coastal oceanography with special reference to near shore processes.

10 - Chemical Oceanography (30 lectures):

Geochemistry of sea water, dynamics of nutrient exchange, dissolved organic constituents, CO_2 - System, anoxic basins, analytical chemistry of sea water.

Practical Physical and Chemical Oceanography (2 hr/week):

Nutrient salts (40 hr/year) - Analysis of physical and chemical data relevant to the shore (20 hr/year).

IIIf - Geological Oceanography (B.Sc.4)

11 - Recent marine sediments (30 lectures):

Sources, transportation and deposition - Depth ranges of pelagic sediments and distribution of calcium carbonate - General features

of sediments, rate of sedimentation, occurrence and activity of bacteria in marine sediments, organic content - Geochemistry and radio-activity of recent marine sediments.

12 - Geology of Egypt (30 lectures):

with special reference to paleogeography and the tectonic frame-work of Egypt.

13 - Paleontology (20 lectures):

Tertiary to recent fauna including mega and micro-fauna.

14 - Economic Geology (10 lectures):

Mineral resources of the sea.

Practical submarine Geology (4 hr/week):

(1) Paleontology (2 hr/week).
(2) Methods of study of recent marine sediments: chemical and mineralogical (2 hr/week).

P.S. 1 - Third year student of Oceanography who pass successfully their exams should attend summer courses and training for 6 weeks in oceanographic and fishery centres as well as on fishing boats of the Egyptian Organization of Aquatic Resources.

2 - Training of the fourth year students undertaking oceanography includes also field work for two weeks during the academic year.

CURRICULA FOR THE DIPLOMA OF HIGHER STUDIES IN OCEANOGRAPHY

(Special Group for Aquatic Resources)

(For B.Sc. students graduated in Zoology and Chemistry or Zoology and Botany).

Da - Biological Oceanography

1 - Introduction to Oceanography (10 lectures):

Historical background, famous Oceanographic expeditions, development of the Science of Oceanography, chief apparatus and gear regularly used aboard ship with particular reference to the methods of obtaining biological samples.

2 - Phytoplankton Ecology: (20 lectures):

Composition, Productivity, Primary production and factors affecting production. Distribution in relation to environmental conditions. Methods of quantitative estimation. Methods of culturing phytoplankton. Interrelations with Zooplankton.

3 - Zooplankton Ecology: (10 lectures):

Definition, Composition, Adaptations to pelagic life, occurrence and seasonal variations in relation to environmental conditions. Types of distribution and methods of quantitative estimations.

4 - Benthos: (10 lectures):

Benthic life and types of benthic habitats, Composition in relation to depth and environmental conditions, Littoral benthos: Characters, feeding, reproduction, Associations and mode of living.

5 - Marine Physiology: (10 lectures):

Salinity and Osmatic regulation in aquatic animals. Food and feeding mechanisms. Marine bacteria and Biolumenescence.

6 - Systematic Study of Marine Flora and Fauna: (30 lectures):

Marine fungi, Algae, sea grasses, Diatoms, Dinoflagellates, Coccolithophorida, Ebriidae, Silicoflagellates, Radioloria, Acantharia, Tintinnidae, Coelenterata, Bryozoa, Chaetognatha, Crustacean, Polychaeta, Echinoderms, Mollusca, Tunicata.

Practical Courses in Biological Oceanography: (4 hr/week):

Examination and estimation of plankton. Quantitative methods of estimating phytoplankton production. Study of representative types of plant and animal life in the Sea. Culture of phytoplankton. Breeding and metamorphosis of marine invertebrates.

Db - Fish Biology and Fisheries

7 - Advanced ichthyology (20 lectures):

Morphology, anatomy, taxonomy, reproduction, life history and geographical distribution of fishes.

8 - Fish Biology (20 lectures):

Age, growth and year class abundance, fecundity, migration, food and feeding. Life histories of Egyptian fishes. Fish diseases.

9 - Fish Physiology and Behaviour (20 lectures):

Digestion, circulation, respiration, metabolism serology, reproduction and endocrines, osmoregulatory mechanisms. Fish behaviour.

Practical fish biology and fisheries (8 hr/week):

(1) Study of morphology and taxonomy of fishes. Identification and classification of Egyptian fishes with particular reference to the Red Sea and Mediterranean types. (4 hr/week)
(2) Fish physiology: Experiments on metabolism, Cardiograms and heart perfusion, estimation of proteins, amino acids and urea and cholesterol in fish blood. Total nitrogen in tissues, osmoregulation. (2 hr/week)
(3) Fecundity, life history, food and feeding, age and growth of fishes. (2 hr/week)

Dc - Fisheries Management and Organization

10 - Fisheries management and organization (20 lectures)

Population dynamics, yield and optimum yield mortality and recruitment, laws and bylaws. Fish culture.

11 - Egyptian Fisheries (10 lectures):

Discussion of Inland and Lake Sea fisheries, present conditions and prospects. Relation to world fisheries.

12 - Biostatics (15 lectures)

Application of statistical methods to biological data with particular reference to population dynamics.

Dd - Fishing Methods and Gear

13 - Fishing Methods and Gear (30 lectures)

Historical, types of gear and nets employed, net designing and net preservations, fish prospecting, detection and attraction. Fishing gear and methods employed in Egyptian waters.

De - Fishery Hydrography

14 - Fishery Hydrography (10 lectures)

Effect of hydrographic and meteorological factors on fish behaviour and fisheries.

Df - Physical and Chemical Oceanography

15 - Physical Oceanography (25 lectures)

Physical properties of sea water, thermal, optical, sonic properties, salinity and temperature distribution, water masses, waves and currents.

16 - Chemical Oceanography (25 lectures)

Chlorinity, salinity, chemical composition of sea water, nutrients, gases in sea water, pH and alkalinity.

Practical physical and chemical oceanography (4 hrs/week):

(1) Representation and processing of oceanographic data (1 hr/week)
(2) Determination of chlorinity, salinity, alkalinity, dissolved oxygen and nutrients. (3 hrs/week)

Dg - Geological Oceanography

17 - Geological Oceanography (30 lectures):

History and origin of ocean basins, origin of water masses - Generalities of the ocean basins, area, volume, depth nomenclature and classification - General terminology of submarine topography, relief of the sea floor, elevations and depressions - Regions of ocean floor, shore line, beach continental terrace and abssal plain - Marine environments of deposition, Littoral, neretic etc. - Recent marine sediments, constituents, classification and types - Coral reef formation.

Dh - Marine Survey

18 - Marine Survey and Cartography (15 lectures):

Practical (2 hrs/week)

N.B.: Students are required to attend training at Sea once a week during the academic year, in addition to summer training at the oceanographic and fishery centres.

CURRICULA FOR THE DIPLOMA OF HIGHER STUDIES IN OCEANOGRAPHY

(For B.Sc. students who attended for at least two years two of the following subjects: Physics, Chemistry, Zoology, Botany, Geology).

Da - Biological Oceanography

1 - Marine Ecology

Introduction to Oceanography (10 lectures)

Historical background, famous oceanographic expeditions, development of the science of oceanography, relation of oceanography to other sciences, chief apparatus and gear regularly used aboard ship with particular reference to the methods of obtaining biological samples.

Phytoplankton (15 lectures)

Composition, Productivity, Primary production and factors affecting production. Distribution in relation to environmental conditions. Methods of quantitative estimation. Methods of culturing phytoplankton. Interrelation with zooplankton.

Zooplankton (10 lectures):

Definition, Composition, Adaptations to pelagic life, occurrence and seasonal variations in relation to environmental conditions. Types of distribution and methods of quantitative estimations.

Benthos (15 lectures)

Benthic life and types of benthic habitats, composition in relation to depth and environmental conditions. Littoral benthos: Characters, feeding, reproduction, associations and mode of living. Abyssal benthos: Composition and Characters.

2 - Marine Physiology (10 lectures)

Salinity and osmotic regulation in aquatic animals. Food and feeding mechanisms, biolumenescence and marine bacteria.

3 - Systematic Study of Marine Flora and Fauna (30 lectures)

Marine algae, sea grasses and diatoms. Important groups of marine protozoa (Dinoflagellata, Coccolithophorida, Ebridae, Radioloria, Coelentrata, Crustacea and Polychaeta, Tunicata, etc.

Practical Courses in Biological Oceanography (4 hr/week):

Quantitative methods of estimating phytoplankton production. Examination and estimation of zooplankton. Study of representative types of plant and animal life in the sea.

Db - Fish Biology and Fisheries

4 - Ichthyology and Fish Biology (30 lectures):

Outline of morphology, anatomy, classification and biology of fishes. Principles of fishery biology (Age determination and growth, breeding and feeding, migration, fish diseases).

5 - Fisheries Management and Fishing Methods and Gear (30 lectures):

Population dynamics, laws and bylaws, principles of fish culture, Egyptian fisheries with relation to world fisheries. Net designing and preservation, types of fishing gear and methods employed in Egypt.

Practical Courses in Fish Biology and Fisheries (4 hr/week):

Morphology, anatomy and taxonomy of fishes with special reference to Egyptian fishes. Food and feeding, age determination and growth, breeding and life histories.

Dc - Physical Oceanography

6 - Physical Properties of Sea Water (15 lectures):

Properties depending on salinity, temperature and pressure, transparency of sea water, sonic properties, state of motion of water, etc. Radiations, evaporation and heat budget of the ocean. Distribution of salinity and temperature in the sea.

7 - Dynamical Oceanography (35 lectures):

Waves (general considerations, progressive and stationary waves, forced and free waves), Tides (theories and classification, tide generating forces, cotidal charts, tides in estuaries and rivers, prediction of tides). Principles of mechanics, forces due to earth's rotation. Ocean currents (gradient currents, wind currents, tidal currents, thermodynamics of ocean currents). Oceanic circulation.

8 - Marine Meteorology (10 lectures):

Practical Course in Physical Oceanography (2 hr/week)

Temperature measurements, the protected and unprotected thermometers, correction, thermometric depth. Curve tracing representing the vertical and horizontal distribution of temperature, oxygen and salinity in sea water, T.S. diagrams. Calculation of the density in situ and the computation of dynamic heights using temperature and salinity data.

De - Chemical Oceanography

9 - Chemical Composition of Sea Water (30 lectures):

Salinity, chlorinity and density, major and minor constituents, dissolved gases in sea water, dissolved organic matter, hydrogen ion concentration, and buffer mechanism of sea water. Alkalinity and the carbon dioxide system in sea water.

10 - Geochemistry and Nutrient Salts (20 lectures):

Principles of colorimetric analysis, methods of colour comparison and apparatus used in colorimetric analysis. Determination of nutrients in sea water (phosphate, nitrate, silicate). Nutrient salts, cycles and distribution in the oceans and seas. Analytical chemistry of sea water.

11 - Fishery Hydrography (10 lectures):

Effect of physical and chemical factors on fishes and fisheries.

Practical Courses in Chemical Oceanography (6 hr/week)

The quantitative determination of chlorides by Volhard's and Mohr's method. The determination of chlorinity and salinity of sea water using Knudsen's method. The determination of dissolved oxygen in sea water by Winkler's method. pH determination of sea water, (colorimetric and electrometric), the determination of the alkalinity of sea water by Wattenberg's method. Colorimetric determination of phosphates, nitrates, nitrites and silicates.

Df - Geological Oceanography

12 - Geological Oceanography (30 lectures):

History and origin of ocean basins, origin of water masses - Generalities of the ocean basins, area, volume, depth nomenclature and classification - General terminology of submarine topography, relief of the sea floor, elevations and depressions - Regions of ocean floor, shore line, beach continental terrace and abyssal plain - Marine environments of deposition, littoral, neritic etc. - Recent marine sediments, constituents, classification and types - Coral reef formation.

Dg - Statistics

13 - Statistical Treatment of Oceanographic Data (15 lectures):

Application of statistical methods for treatment and presentation of oceanographic data with special reference to biological data.

Dh - Marine Survey

14 - Marine Survey and Cartography (15 lectures):

Practical Course in Marine Survey and Cartography (2 hr/week):

Location of position at sea, sounding and construction of charts.

N.B.: Students are required to attend training at sea once a week during the academic year, in addition to summer training at the oceanographic and fishery centres.

APPENDIX II

PUBLICATIONS IN THE MARINE SCIENCES BY EGYPTIAN SCIENTISTS

A.A. Aleem, Distribution and ecology of the sea-grass communities in the Indian Ocean, 2nd International Oceanographic Congress, No. 2, (1966).

Samy Gorgy, Survey of U.A.R. fisheries grounds; hydrographic results of the Shoyo-Maru Expedition in the Mediterranean and Red Seas, Notes and Memoires No. 71, Oceanographic and Fisheries Research Centre, (1964).

A.M. El-Maghraby, Studies on the maturity of the Egyptian sardine belonging to the genus Sardinella. Bull. Faculty Sci., Alexandria, V:17-30, (1963).

A.M. El-Maghraby, The seasonal variations in length of some marine planktonic copepods from the eastern Mediterranean at Alexandria. Crustaceana, 8, 3747, (1965).

A.M. El-Maghraby and Y. Halim, A quantitative and qualitative study of the plankton of Alexandria waters, Hydrobiologia, XXV, 221-238, (1965).

S.A. Morcos and J.P. Riley, Chlorinity, salinity, density, and conductivity of sea water from the Suez Canal region. Deep-Sea Research, 13, 741-750, (1966).

S.A. Morcos, Effect of the Aswan High Dam on the current regime in the Suez Canal. Nature (London), 214, 901, (1967).

A.A. Al-Kholy, Some semi-parasitic Copepoda from the Red Sea. Publ. Mar. Biol. Sta. Ghardaga, Red Sea, 12, 127-136 (1963).

A.A. Al-Kholy, The zoeal stages of Tetralia glaberrima (Herbst) from the Red Sea, Publ. Mar. Biol. Sta. Ghardaga, Red Sea, 12, 137-144, (1963b).

A.A. Al-Kholy, Some larvae of decapod Crustacea from the Red Sea. Publ. Mar. Biol. Sta., Ghardaga, Red Sea, 12, 159-176, (1963c).

H.A.F. Gohar and A.M. Eisawy, The egg-masses and development of Trochus (Infundibulops) erythraeus Brocchi. Publ. Mar. Biol. St., Ghardaga, Red 12, 191-204, (1963).

H.A.F. Gohar and F.M. Mazhar, The elasmobranchs of the North-Western Re Sea, Publ. Mar. Biol. Sta., Ghardaga, Red Sea, 13, 1-144, (1964a).

H.A.F. Gohar and F.M. Mazhar, The internal anatomy of Selachii from the North-Western Red Sea, Publ. Mar. Biol. Sta., Ghardaga, Red Sea, 13, 145-240, (1964b).

H.A.F. Gohar and F.M. Mazhar, Keeping elasmobranchs in vivaria. Publ. Mar. Biol. Sta., Ghardaga, Red Sea, 13, 241-250, (1964c).

H.A.F. Gohar and A.F.A. Latif, Digestive proteolytic enzymes of some Scarid and Iabrid fishes from the Red Sea, Publ. Mar. Biol. Sta., Ghardaqa, Red Sea, 12, 3-42, (1963a).

H.A.F. Gohar and A.F.A. Latif, Gastric and intestinal absorption of olive oil and oleic acid in Clarias lazera C. and V., Publ. Mar. Biol. Sta., Ghardaqa, Red Sea, 12, 43-64, (1963b).

H.A.F. Gohar and G.N. Soliman, On three Mytilid species boring in living corals, Ibid 12, 65-98, (1963a).

H.A.F. Gohar and G.N. Soliman, On the biology of three Coralliphilids boring in living corals, Ibid 12, 99-126, (1963b).

H.A.F. Gohar and G.N. Soliman, Biology and development of Hexabranchus sanguineus (Rupp. and Leuck.), Ibid 12, 219-247, (1963c).

Y. Halim, Microplancton des eaux egyptiennes. II. Chrysomonadines; Ebriediens et Dinoflagelles nouveau ou d'interet biogeographique. Com. int. Explor. sci. Mer Medit., Rapp. et P.V. 18, 373-379, (1965).

Y. Halim, Microplancton des eaux egyptiennes. Le Genre Ceratium Schrank (Dinoflagelles), Ibid 17, 495-502, (1963).

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13. ABSTRACT

The report describes the organization of marine sciences in Egypt and considers the staff, research facilities, and research interests at the institutions which have programs in marine biology and oceanography. These include the University of Alexandria, the Marine Laboratory at Al-Ghardaqa, the Institute of Oceanography and Fisheries at Suez, and the Oceanographic and Fisheries Research Centre at Alexandria.

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